

Exploration Review

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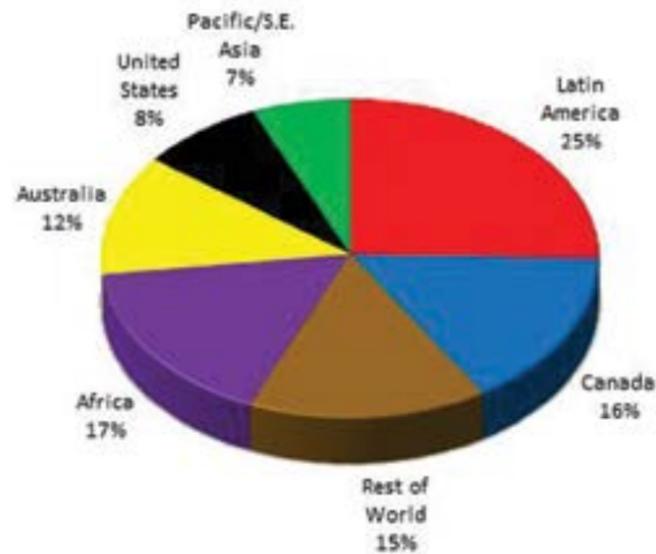
This summary of international mineral exploration activities for 2012 draws upon information from industry sources, published literature and U.S. Geological Survey (USGS) specialists. The summary provides data on exploration budgets by region and mineral commodity, identifies significant mineral discoveries and areas of mineral exploration, discusses government programs affecting the mineral exploration industry and presents analyses

budgets for worldwide exploration activities in 2012 for 20 mineral commodities, based on surveys returned by companies primarily focused on precious (gold, platinum-group metals and silver) and base (copper, lead, nickel and zinc) metals. Information on uranium exploration activities was included in the MEG overview for the first time in 2007. MEG included data on lithium, niobium, phosphate, potash, rare-earth elements and tantalum for the first time in 2010 because of the increased topical significance of these commodities. Since 1999, companies with exploration budgets of \$100,000 and greater were included in the MEG compilation. MEG estimates that its post-1999 surveys cover at least 90 percent of world nonferrous nonfuel mineral exploration budgets. The 2012 survey is reported by MEG to cover an estimated 95 percent of these budgets. The remaining 5 percent was composed of companies that chose not to participate in the MEG study, private companies that do not publish their budget data and government-funded exploration activities.

USGS data compilations and analyses are based on information provided by USGS mineral commodity and country specialists and by other USGS scientists, as well as industry contacts and published trade journals. The USGS data summarize exploration site data collected for more than 80 minerals and materials, with a focus on nonfuel minerals including base metals, diamond and precious metals. Iron ore and uranium were included in the USGS analysis after 2007. The USGS analyzed the MEG exploration budget data, the compiled site activity data and available information on regional conditions and influences to assess the level of exploration activity in 2012 and to report trends in mineral exploration activity for the period 2002 through 2012. This analysis identifies where mineral exploration is occurring by commodity and region, assesses how much activity is taking place in each region for selected mineral commodities and determines those factors that most affect any changes in this exploration activity.

Certain limitations apply when comparing estimates or evaluating the magnitude of regional changes from year to year because as worldwide exploration allocations have increased, so too have energy, labor, service and material costs associated with mineral exploration. Consequently, an exploration budget of \$1 million allocated in 2012 would yield less exploration activity than a corresponding budget in 2002. Fluctuations in

Figure 1
Planned worldwide exploration budgets for analyzed nonfuel mineral commodities by region for 2012 (2,556 companies' budgets, totaling US\$20.53 billion). Source: SNL Metals Economics Group.

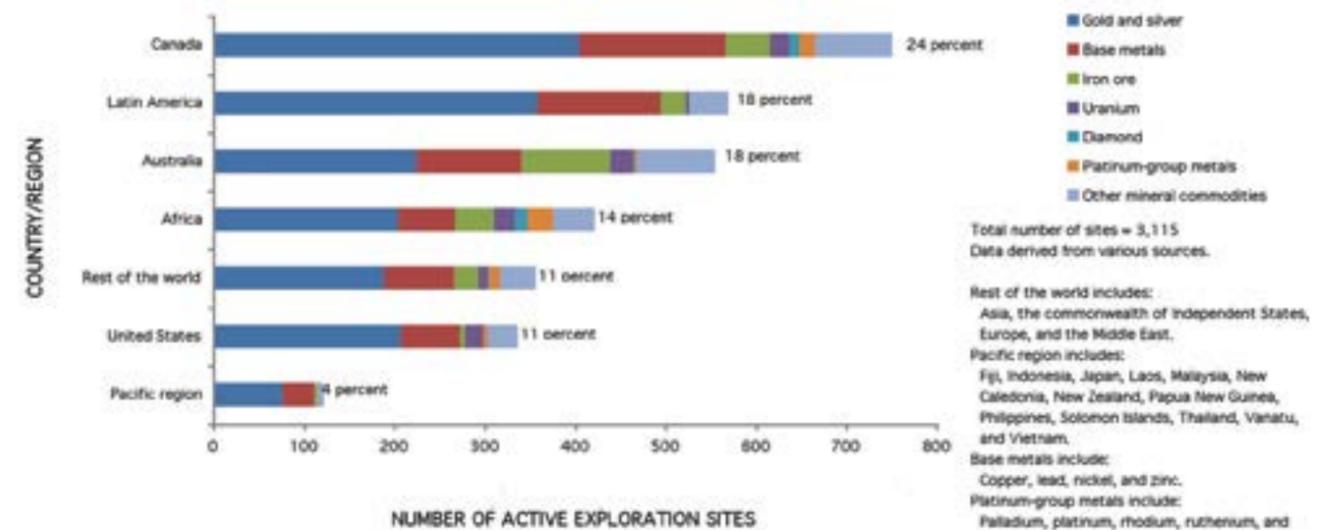


of exploration activities performed by the mineral industry.

Three sources of information are reported and analyzed in this annual review of international exploration for 2012: 1) budgetary statistics expressed in U.S. nominal dollars provided by SNL Metals Economics Group (MEG) of Halifax, Nova Scotia; 2) regional and site-specific exploration activities that took place in 2012 as compiled by the USGS and 3) regional events including economic, social and political conditions that affected exploration activities, which were derived from published sources and unpublished discussions with USGS and industry specialists.

The MEG data summarize planned company

Figure 2
Number of active exploration sites by region as compiled by the U.S. Geological Survey.



currency exchange rates and the value of trading currencies over time can influence the business pattern of foreign companies conducting business in other countries. Unless otherwise specified, this analysis does not take currency fluctuations into account and expresses worldwide exploration activity in U.S. nominal dollars to simplify comparisons by commodity and region.

Temporal interpretations of the MEG exploration data such as trend analyses are also limited by changes in survey parameters, because the sample of exploration and mining companies surveyed by MEG varies with time, companies included in the survey change on a year-to-year basis and fluctuation of currency exchange rates affects the relative value of budget estimates from year to year. Also, commodity and country coverage may differ from year to year. Post-1999 data reported in this summary differ from prior-year data in that a larger number of companies were included in the more recent survey results. The significant amount of corporate restructuring that took place since 2000 also affected statistical compilations. MEG included 229 more companies in their 2012 survey than it did in 2011.

2012 global mineral exploration activity and trends for 2000 through 2011

According to MEG, the total estimated worldwide budget allocation for nonferrous mineral exploration increased by about 19 percent in 2012 to about \$20.5 billion (on the basis of data from about 2,300 companies when uranium and iron ore are excluded) from the 2011 budget allocation of about \$16.3 billion (2,100 companies). MEG annual survey estimates reflect budgeted expenditures rather than actual dollars spent, and reflect an estimated 95 percent of worldwide

exploration. Despite increasing volatility, metals prices remained relatively strong in 2012, and industry confidence was sufficiently strong enough to support a variety of active exploration programs.

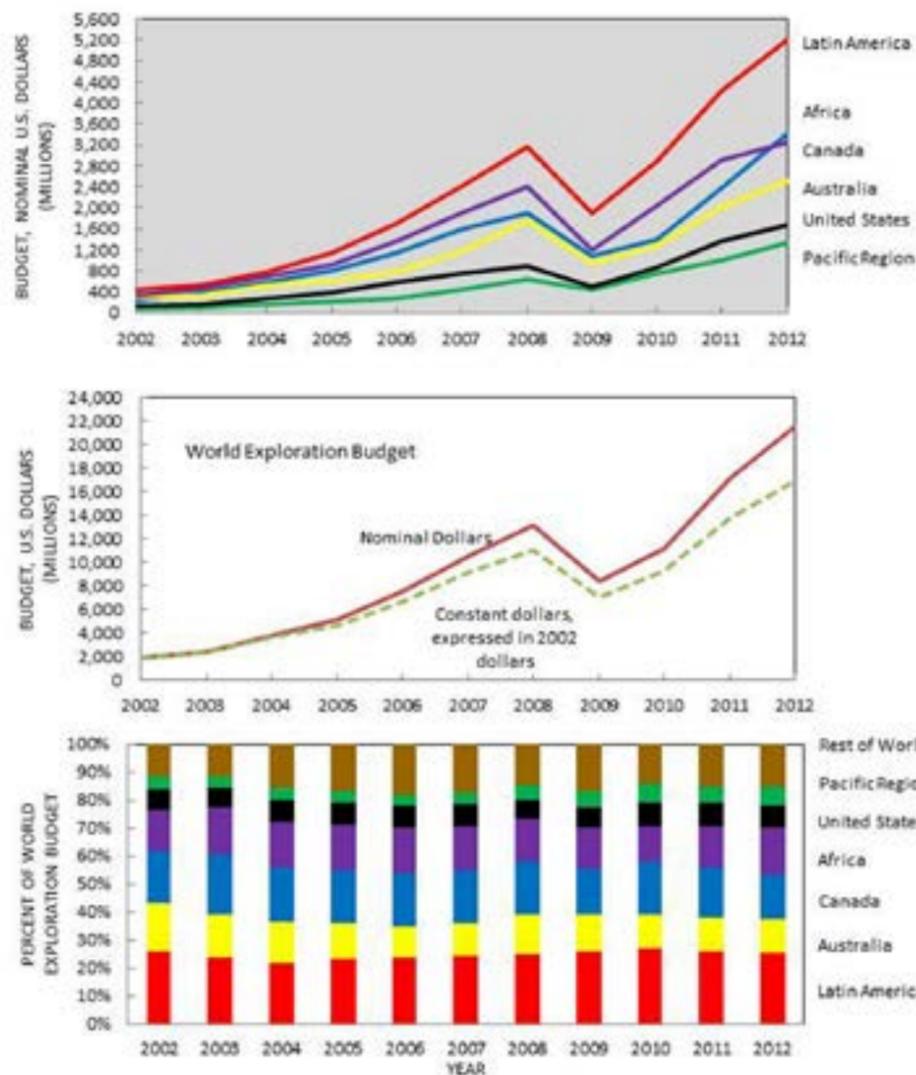
Based on MEG's annual industry survey, companies planned an average increase in drilling of about 2,850 m (9,350 ft), a 6-percent year-on-year increase. This is less than the average 14,000 m (46,000 ft) increase in drilling during 2011. However, this planned increase in drilling lagged behind the increased budget estimates by these same companies, owing to higher drilling costs, increased use of other exploration techniques, as well as other factors. Increased exploration activity and drilling require a greater labor force for the exploration sector. MEG data suggest that the labor force increased about 17 percent on average in 2012 from 2011. Surveys conducted by Deloitte Development LLC (2012) and Ernst & Young (2012) suggest that there may be a growing labor shortage of skilled geoscientists in the future.

Higher demand for assaying, drilling and geophysical services, coupled with increasing fuel and labor costs, increased the overall cost of exploration. Data compiled from the MEG survey reported an average cost increase of 8 percent in 2010 and 2011 and projected a 7 percent cost increase in 2012, 2013). Consequently, it is likely that cost increases that occurred since 2009 reduced the amount of exploration activity that could be conducted in 2012 from that conducted in 2009, given a similar exploration budget.

Figure 1 shows the 2012 worldwide minerals exploration budgets allocated by region, based on MEG data. MEG "regions" reflect a mixture of individual countries, continents and other groupings, but they are reported consistently on an annual basis and provide a means of assessing

Figure 3

Trends in reported exploration budgets for nonfuel minerals in selected regions, 2002 through 2012. Source: Metals Economics Group.



the flow of budgeted exploration expenditures from year to year¹. According to MEG, the top four geographic areas for exploration in 2012 (excluding the Rest of the World grouping), in decreasing budget order, were Latin America, Africa, Canada and Australia. Regional budget allocation estimates derived from MEG data for 2012 when iron ore is excluded were: Latin America, \$5.2 billion; Africa, \$3.4 billion; Canada, \$3.2 billion; Australia, \$2.5 billion; the United States, \$1.7 billion and the Pacific region, \$1.3 billion. Exploration taking place in countries

from Figs. 1 and 2 are compared, the percentage contribution expressed in terms of exploration sites in Australia, Canada and the United States is higher than the percentage contribution expressed in terms of exploration budget, suggesting that there may be more lower-budget, early-stage sites in these regions. In Latin America, however, the percentage contribution expressed in terms of exploration budget is higher than the contribution expressed in terms of the number of sites, suggesting that there are a greater number of sites at an advanced stage of exploration with a higher

¹As defined by MEG, Latin America includes the Caribbean, Central America, Mexico and South America. The Pacific region includes Fiji, Indonesia, Japan, Laos, Malaysia, New Caledonia, New Zealand, Papua New Guinea, Philippines, Solomon Islands, Thailand, Vanuatu and Vietnam. The rest of the world includes China, Europe, India and Pakistan, the Middle East and republics of the Commonwealth of Independent States. Australia, Canada and the United States are treated separately.

included in the Rest of the World category totaled \$3.1 billion, of which China and Russia accounted for 46 percent of the region's budget total. The largest increase in dollar terms took place in Latin America and Africa; the smallest increase took place in Canada and the United States. In terms of the percentage share of worldwide budget, the largest increase took place in Africa and the largest decrease took place in Canada.

For 2012, information for more than 3,100 exploration sites was gathered by USGS specialists from published literature and industry sources. The regional distribution of these exploration targets is represented in Fig. 2 by principal commodity target, based on the number of projects reported for each region. Canada remained the top destination in terms of active exploration sites in 2012, followed by Latin America, Australia and Africa. The number of sites that are actively being explored does not necessarily correlate directly to exploration budget estimates, but it is another indicator of relative interest, reflects market conditions, commodity prices, and local political or social conditions, and shows the effect of recent discoveries on regional exploration activity. When data

Table 1

Prices for selected base and precious metals, 2002 to 2012.

Commodity	Average nominal price for specified year, expressed in U.S. currency										
	2002 ¹	2003 ¹	2004 ¹	2005 ¹	2006 ¹	2007 ¹	2008 ¹	2009 ¹	2010 ²	2011 ²	2012 ²
Copper ³	0.76	0.85	1.34	1.73	3.15	3.28	3.19	2.41	3.48	4.06	3.67
Gold ⁴	311	365	411	446	606	699	874	975	1,227	1,572	1,700
Lead ⁵	0.44	0.44	0.55	0.61	0.77	1.24	1.20	0.87	1.09	1.22	1.14
Nickel ⁶	3.07	4.37	6.27	6.69	11	16.88	9.57	6.65	9.89	10.38	7.99
Palladium ⁷	340	203	233	204	323	357	355	266	531	739	749
Platinum ⁸	543	694	849	900	1,144	1,308	1,578	1,208	1,616	1,725	1,555
Silver ⁹	4.62	4.91	6.69	7.34	11.57	13.41	15	14.69	20.20	35.26	30
Uranium ¹⁰	9.83	11.24	18.05	27.93	47.68	99.24	64.18	46.67	45.96	56.24	48.90
Zinc ¹¹	0.35	0.38	0.47	0.63	1.49	1.47	0.85	0.75	0.98	1	0.86
Neodymium oxide ¹²	28.5	28.5	28.5	28.5	45	60	50	42	63	270	125

¹ Price reported in U.S. Geological Survey (USGS), Minerals Yearbook series for the years 2002 through 2010.
² Price reported in U.S. Geological Survey, Minerals Commodity Summaries series for the year 2011 or 2012 or updated based on oral and written communications, USGS mineral commodity specialists.
³ U.S. producer cathode (minimum 99.99% pure), reported in \$/lb.
⁴ Englehard Corporation industries quotation, reported in \$/oz.
⁵ North American producer price, delivered (minimum 99.97% pure), in \$/lb.
⁶ London Metal Exchange cash price for primary nickel (minimum 99.80% pure), in \$/lb.
⁷ Unfabricated palladium, reported in \$/oz.
⁸ Unfabricated platinum, reported in \$/oz.
⁹ Handy and Harmon quotation, reported in \$/oz.
¹⁰ Nuexco exchange spot price, reported in \$/lb. by the International Monetary Fund.
¹¹ London Metal Exchange cash price, reported in \$/lb.
¹² Rhodia Electronics & Catalysts Inc., reported in \$/kg.

exploration budget.

Figure 3 summarizes MEG budget data by region for the period 2002 through 2012 in terms of nominal dollars and percent of the world exploration budget. These data show that the planned exploration budget level (expressed in nominal dollars) for 2012 increased from the 2011 level in all regions of the world. Ongoing economic uncertainty in Europe and the United States and concerns over reduced Chinese demand for metals caused most metal prices to decrease or stabilize during much of 2012. However, because prices for many metals remained well above their 2002-2011 averages (Fig. 4), exploration budgets continued to increase in 2012. The largest nominal dollar regional budget increase from 2011 to 2012 of approximately \$990 million took place in Latin America, followed by an increase of about \$800 million for Africa. The smallest increase in nominal exploration budget took place in Canada (\$136 million) and the United States (\$227 million). Based on the amount of percentage change, however, the budget for exploration in Africa showed the largest increase and Canada reported the largest decrease in percentage of all regions.

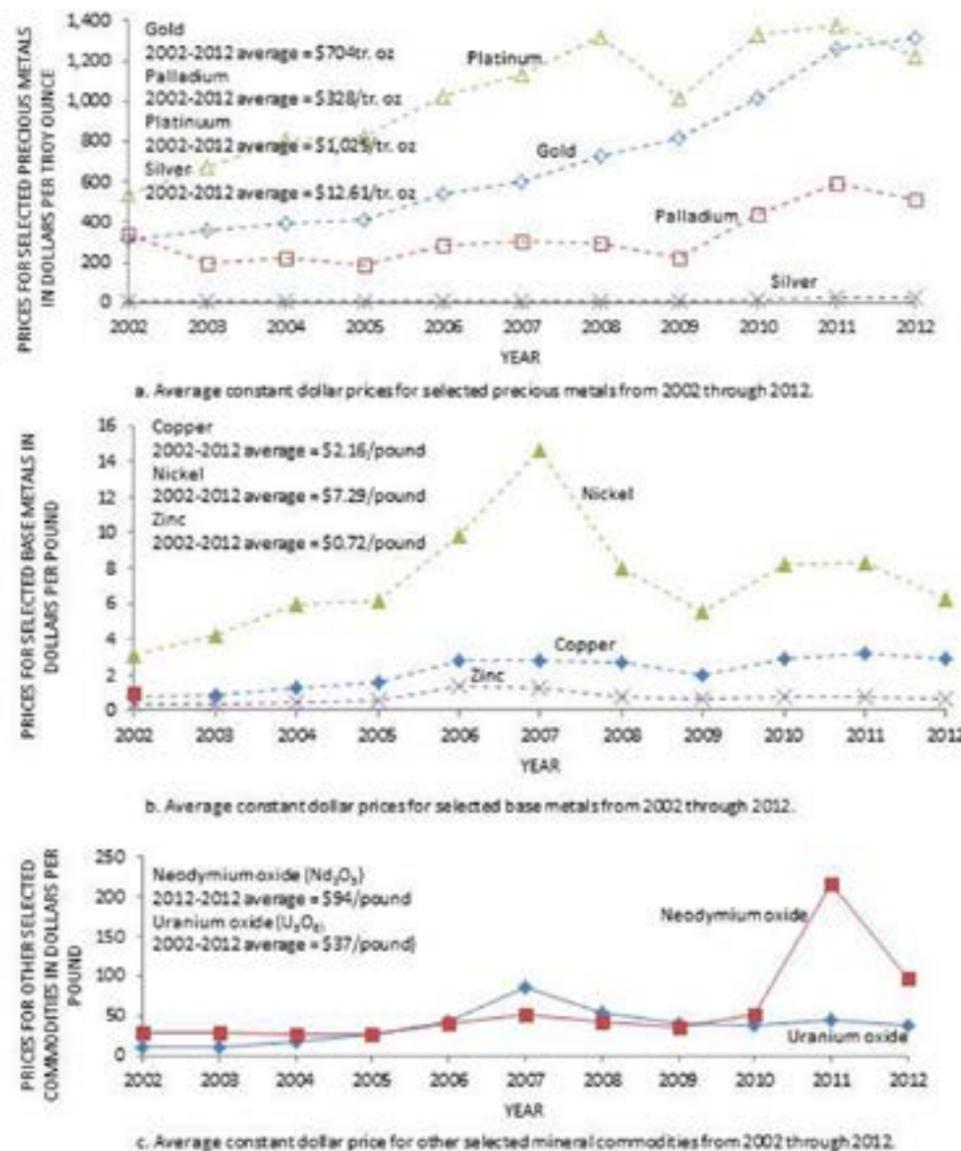
The 2012 MEG mineral exploration statistics suggest that budgeted expenditures for sites at an advanced stage of exploration accounted for about 44 percent of the total exploration budget for 2012, early-stage sites accounted for about 31 percent

and exploration associated with established mine sites accounted for about 25 percent, close to the 2011 percentages of 41, 33 and 26, respectively. Since the mid-1990s, the larger companies have shifted their exploration focus toward advanced stage projects or mine site exploration at the expense of early-stage projects as a less expensive means of replacing or adding mineral reserves. Junior companies have tended to focus on early-stage projects, hoping to attract the interest of a larger company if a project shows potential for further, more capital intensive exploration or development program. The investment growth rate in mineral projects grew 9 percent in 2012, compared to 21 percent in 2010 and 20 percent in 2011, and junior companies had greater difficulty securing financing. One consequence of the decline in early-stage exploration in the last decade is that the number of viable, large-scale assets considered available for development is likely to decrease in the future. This observation coincides with a recent study that suggests that the discovery rate for gold and ore grades have been declining steadily since 1999. During periods of higher metal prices, lower grade material may be classified as ore, resulting in a reduction of the global ore grades.

Recent and anticipated commodity prices contribute to exploration budget development and the amount of activity planned by mineral exploration companies. Table 1 shows the average

Figure 4

Average constant dollar prices for selected (a) precious metals, (b) base metals and (c) other selected mineral commodities from 2002 through 2012. Nominal dollar prices from various sources were indexed using the Consumer Price Index with a base year of 2002.



planned or contracted based on economic considerations at the end of 2011 or early 2012, when metals prices were at levels higher than averages for the past decade.

As shown in Fig. 4, the 2012 average constant dollar price for nine of the 10 selected commodities was lower in 2012 than in 2011. Of the commodities selected for evaluation, only the average gold price was higher in 2012 than in 2011. The 2012 average constant dollar price for gold (89 percent), silver (88 percent), palladium (55 percent), copper (33 percent), lead (19 percent), platinum (19 percent), neodymium oxide (3.8 percent) and uranium oxide (3.7 percent) was higher than the average 2002-2012 constant dollar price for that commodity. Reported percentages reflect this variation. The 2012 average constant dollar price for nickel was 14 percent lower than the average 2002-2012 constant dollar price for nickel, and the 2012 price for zinc was 6.9 percent lower than its 2002-2012 average constant dollar price. These data suggest that, although metal prices generally decreased from 2011 to 2012, they still remain at a comparatively high level and, thus, for 2012 at least, continued to encourage mineral

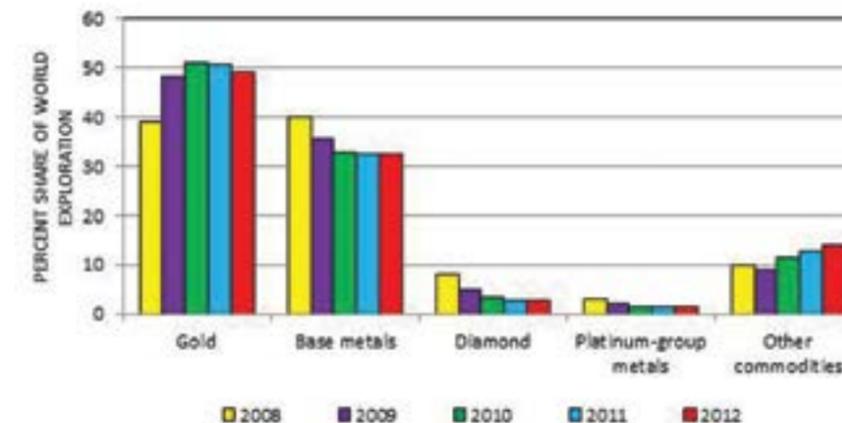
exploration activity. Although prices for many minerals remained high in 2012, prices for platinum and some base metals fell to 2009 levels as demand for these metals declined with reduced demand from China. Metal markets faced increased uncertainty resulting from global, economic instability, resource nationalism and increasing environmental activism. Global economic uncertainty and resource nationalism issues reduced acquisition and joint venture activity during 2012. Major companies focused on high-quality, low-cost projects and placed a number of development projects on hold until the

annual prices for selected metals for the years 2002 through 2012. However, because of metal price instability, reporting just the average prices for the year does not provide enough information to assess the effect of price changes on the level of exploration. Figure 4 shows the annual indexed prices in 2002 constant U.S. dollars for selected (a) precious metals, (b) base metals and (c) other selected mineral commodities from 2002 to 2012. Using constant dollar values based on the Consumer Price Index reduces the effects of inflation on prices of commodities being considered over time. Most 2012 exploration budgets were

market improves. In spite of the high level of exploration activity in 2012 reflected in budgeted expenditures, there are indications that the industry may face increased financial pressures in the near future, particularly if metal prices continue to decline. A survey conducted by Ventyx suggests that there is greater concern from mining executives about managing capital expenditures for projects. Such a focus tends to favor expansion at existing sites. The capital-intensive nature of developing new sites is perceived to generate greater risk, at a time when lenders are more selective in financing. Overall, junior and intermediate exploration companies, which often rely on credit financing or stock offerings, had greater difficulty obtaining capital for exploration activities in 2012 than they did in 2011. Major companies, which often use existing reserves as collateral to acquire the credit necessary for exploration or production revenues to supply cash for future exploration and development, planned to increase spending for mineral exploration in 2012 based on their perception of improving corporate and global economic conditions at the beginning of 2012. Data reported by the Raw Materials Group (RMG) suggested that overall investment activity in the minerals sector was lower in 2012 than in 2011. The RMG data suggest that copper, gold, iron ore and nickel were the most important mineral investment targets in 2012, together accounting for approximately 86 percent of the total project pipeline. In 2012, 130 new mine development projects were announced, compared to 165 projects in 2011. The 2012 RMG study ranks the top five countries for mining investment, in descending order of expenditure, as Australia (primarily for iron ore), Canada (base metals, gold and iron ore), Chile, Brazil and Russia. The United States ranked seventh in the RMG survey. Studies by Ernst and Young and PricewaterhouseCoopers (PwC) suggest that the quantity of mining-related mergers and acquisitions in 2012 was 30 percent lower than those announced for 2011, both in terms of size and volume of deals, the lowest level since 2005. According to the Fraser Institute Survey of Mining Companies 2012-2013, almost 80 percent of the respondent producing companies with more than US\$50 million in revenue reported increasing exploration expenditures from 2007 to 2012, while 34 percent of producers with revenues less than US\$50 million increased exploration expenditures

Figure 5

Worldwide exploration budgets as reported for selected mineral commodity targets, 2008-2012. (Source: SNL Metals Economics Group. Other minerals include cobalt, iron ore, molybdenum, silver and tin.)



during the same period. Approximately 46.5 percent of exploration company respondents increased their exploration budgets, while 38 percent decreased their budgets. Approximately 49 percent of the respondents were exploring for gold and 17 percent were focusing on copper exploration. The 2012-2013 Fraser Institute survey found that 46 percent of the responding exploration companies published in February 2013 planned to increase their budget in 2013 from the 2012 level, compared to 68 percent in 2012 and 82 percent in 2011.

As governments attempt to deal with growing deficits, higher commodity prices have led some governments to consider the mining and metals sector as a source of revenue. Deloitte Development LLC conducted an assessment that suggests one of the top risk areas for mining and metals in 2012 was resource nationalism. Resource nationalism can take many forms, including imposing a resource tax, amending royalty or tax rates, establishing greater controls on foreign participation and encouraging in-country beneficiation and processing by limiting exports or imposing export duties. In the past year, mineral royalties have increased in Australia, Burkina Faso, Chile, Ghana, Peru, South Africa and Tanzania, and new export duties have been imposed in India, Kazakhstan and Russia. Other governments have imposed or proposed super profits taxes or other levies to obtain additional revenue.

During the past decade, the global landscape for mineral exploration and development has changed. Mining and investment companies from countries with rapidly expanding economies such as Brazil, China and India are now looking outside their borders for mineral sources of supply. The China Investment Bank investment division

Selected noteworthy exploration sites for 2012.

Location	Type ¹	Site	Commodity	Company	Resource ² notes	Location	Type ¹	Site	Commodity	Company	Resource ² notes
Africa						Canada continued					
1 Burkina Faso	E	Balogo	Au	Golden Rim Resources Ltd.	185,000 oz Au (IF)	54 Quebec	F	Joanna	Au	Aurizon Mines Ltd.	1.7 Moz Au (R)
2 Burkina Faso	E	Banfora	Au	Gryphon Minerals Ltd.	2.2 Moz Au (D)	55 Quebec	E	Windfall Lake	Au	Eagle Hill Exploration Corp.	538,000 oz Au (ID)
3 Burkina Faso	E	Bombore	Au	Orezone Gold Corp.	4.1 Moz Au (D)	56 Quebec	E	Zeus (Kipawa)	REE, Zr	Matamec Explorations Inc.	77 kt REO, 160 kt, ZrO ₂ (ID)
4 Burkina Faso	E	Batie West/Konkera	Au	Ampella Mining Ltd.	1.3 Moz Au (ID)	57 Saskatchewan	P	Seabee	Au	Claude Resources Inc.	225,000 oz Au (R)
5 Burkina Faso	P	Mana	Au	SEMAFO, Inc.	2 Moz Au (R)	58 Saskatchewan	E	Waterbury Lake	U ₃ O ₈	Fission Energy Corp.	4.7 kt, U ₃ O ₈ (ID)
6 Congo (Brazzaville)	E	HindaPhosphate,	U ₃ O ₈	Cominco Resources Ltd.	53 Mt P ₂ O ₅ , 38 kt U ₃ O ₈	59 Saskatchewan	E	Wheeler River	U ₃ O ₈	Denison Mines Corp. 1	6 kt U ₃ O ₈ (ID)
7 Côte d'Ivoire	F	Tengrela/Sissengue	Au	Perseus Mining Ltd.	655,000 oz Au (R)	60 Yukon Territory	E	Brewery Creek	Au	Golden Predator Corp.	582,000 oz Au (ID)
8 Côte d'Ivoire	E	Mt Yaoure	Au	Amara Mining plc.	477,000 oz Au (D)	61 Yukon Territory	E	Coffee	Au	Kaminak Gold Corp.	3.2 Moz Au (IF)
9 Ghana	P	Cent. Ashanti/Edikan	Au	Perseus Mining Ltd.	3.4 Moz Au (R)	62 Yukon Territory	P	Keno Hill/Bellekeno	Ag, Pb, Zn	Alexco Resource Corp.	12 Moz Ag, 38 kt Pb, 26 kt, Zn (ID)
10 Ghana	F	Obotan	Au	PMI Gold Corp.	3.1 Moz Au (D)	63 Yukon Territory	E	Klaza	Au, Ag	Rockhaven Resources Ltd.	Data not released.
11 Ghana	F	Wa-Lawra	Au	Azumah Resources Ltd.	431,000 oz Au (R)	64 Yukon Territory	E	Rackla	Au, Ag	ATAC Resources Ltd.	508,000 oz Au, 846,000 oz Ag
12 Liberia	E	Western Cluster	Fe	Sesa Goa Ltd.	330 Mt Fe (T)	Latin America					
13 Mali	E	Fekola	Au	Papillon Resources Ltd.	3.5 Moz Au (D)	65 Argentina	E	Altar	Cu, Au	Stillwater Mining Co.	3.4 Mt Cu, 1.5 Moz Au (D)
14 Mali	E	Siribaya	Au	Iamgold Corp.	304,000 oz Au (ID)	66 Argentina	P	San Jose	Ag, Au	Hochschild Mining plc.	22 Moz Ag, 344,000 oz Au (R)
15 Morocco	E	Achmmach	Sn	Kasbah Resources Corp.	42 kt Sn (ID)	67 Argentina	E	Taca Taca	Cu, Au, Mo	Lumina Copper Corp.	9.5 Mt Cu, 7.7 Moz Au, 281 kt Mo (ID)
16 Senegal	P	Sabodala/OJVG	Au	Teranga Gold Corp.	1.7 Moz Au (R)	68 Brazil	E	Volta Grande	Au	Belo Sun Mining Corp.	4.1 Moz Au (D)
17 Sierra Leone	E	Komahun	Au	Polo Resources Ltd.	521,000 oz Au (ID)	69 Chile	E	Cerro Maricunga	Au	Atacama Pacific Gold Corp.	2.7 Moz Au (D)
18 South Africa	E	Platreef	PGM, Au, Ni,	Culvanplats Ltd.	29 Moz 3PGM+Au, 758 kt Ni, 357 kt Cu (ID)	70 Chile	P	El Penon	Au, Ag	Yamana Gold Inc.	2.2 Moz Au, 66 Moz Ag (R)
19 South Africa	E	Waterberg	PGM, Au	Platinum Group Metals Ltd.	9.1 Moz 2PGE, 1 Moz Au (IF)	71 Chile	E	Los Helados	Cu, Au	NGEx Resources Inc.	4.7 Mt Cu, 6.8 Moz Au (ID)
20 Tanzania	E	Mtonya	U ₃ O ₈	Uranium Resources plc.	Data not released.	72 Colombia	E	Berlin	U ₃ O ₈ , V ₂ O ₅ , Ni, Mo, Ni, P ₂ O ₅ , REO	U ₃ O ₈ Corp.	600 t U ₃ O ₈ , 2.4 kt, V ₂ O ₅ , 1.2 kt 340 t Mo, 50.4 kt P ₂ O ₅ , 350 t REO
21 Zambia	E	Mumbwa	Cu, Au, Ag	Blackthorn Resources Ltd.	1 Mt Cu, 103,000 oz Au, 2.3 Moz Ag (ID)	73 Colombia	E	Buritica	Au, Ag, Zn	Continental Gold Ltd.	1.6 Moz Au, 4.6 Moz Ag, 26 kt Zn (D)
22 Zambia	E	Trident	Cu, N	iFirst Quantum Minerals Ltd.	3.9 Mt Cu, 360 Mt Ni (R)	74 Guyana	E	Matthews Ridge	Mn	Reunion Mining Corp.	4.1 Mt Mn (ID)
Australia						75 Mexico	E	Sierra Mojada	Ag, Zn	Silver Bull Resources Inc.	47 Moz Ag, 279 kt Zn (ID)
23 South Australia	E	Central Eyre	Fe	Iron Road Ltd.	177 Mt Fe (ID)	76 Mexico	E	La India	Au	Agnico-Eagle Mines Ltd.	930,000 oz Au (PR)
24 South Australia	E	Hillside	Cu, Au, Fe	Rex Minerals Ltd.	636 kt Cu, 540,000 oz Au, 15 Mt Fe (PR)	77 Mexico	P	Mulatos	Au	Alamos Gold Inc.	2.4 Moz Au (R)
25 Western Australia	D	Garden Well/Rosemont	Au	Regis Resources Ltd.	2.3 Moz Au (R)	78 Mexico	E	San Antonio	Au	Argonaut Gold Inc.	1.7 Moz Au (D)
26 Western Australia	E	Mt Ida	Fe	Jupiter Mines Ltd.	321 Mt Fe (ID)	79 Mexico	P	San Francisco	Au	Timmins Gold Corp.	1.3 Moz Au (R)
Canada						80 Mexico	E	San Miguel	Ag, Au	Paramount Gold & Silver Corp.	54 Moz Ag, 638,000 oz Au (ID)
27 British Columbia	E	Aley	Nb	Taseko Mines Ltd.	1 Mt Nb ₂ O ₅ (D)	81 Mexico	E	Tuligtic	Au, Ag	Almaden Minerals Ltd.	953,000 oz Au, 55 Moz Ag (ID)
28 British Columbia	E	Blackwater-Davidson	Au, Ag	New Gold Inc.	7.1 Moz Au, 34 Moz Ag (ID))	82 Panama	E	Cerro Quema	Au, Cu	Pershimco Resources Inc.	569,000 oz Au, 6.6 t Cu (ID)
29 British Columbia	F	Brucejack	Au, Ag	Pretium Resources Inc.	9.4 Moz Au, 49 Moz Ag (D)	83 Peru	E	Azuca	Ag, Au	Hochschild Mining plc.	35 Moz Ag, 134,000 oz Au (ID)
30 British Columbia	E	Galore Creek	Cu, Au, Ag	NovaGold Resources Inc.	3 Mt Cu, 5.4 Moz Au, 102 Moz Ag (R)	Pacific (Including Southeast Asia)					
31 British Columbia	F	KSM	Au, Cu, Ag, Mo	Seabridge Gold Inc.	38 Moz Au, 4 Mt Cu, 191 Moz Ag, 96.7 kt Mo (R)	84 Philippines	E	Bananghilig	Au	Medusa Mining Ltd.	608,000 oz Au (ID)
32 British Columbia	E	Ootsa/Seel	Cu, Au, Mo, Ag	Gold Reach Resources Ltd.	142 kt Cu, 370,000 oz Au, 10 kt Mo, 4.4 Moz Ag (ID)	85 Philippines	E	Basay	Cu	Copper Development Corp.	629 kt Cu (IF)
33 British Columbia	E	Premier	Au	Ascot Resources Ltd.	1.3 Moz Au, 8 Moz Ag (ID)	United States					
34 British Columbia	E	Spanish Mountain	Au	Spanish Mountain Gold Ltd.	2.5 Moz Au, 2.9 Moz Ag (D)	86 Alaska	E	Golden Summit	Au	Freemgold Ventures Ltd.	1.6 Moz Au (ID)
35 British Columbia	E	Woodjam	Cu, Au	Gold Fields Ltd.	483 kt Cu, 282,000 oz Au (IF)	87 Arizona	E	Hermosa/Hera	Ag	Wildcat Silver Corp.	171 Moz Ag (ID)
36 Manitoba	P	Rice Lake	Au	San Gold Corp	250,000 oz Au (R)	88 Nevada	P	Cortez/Goldrush	Au	Barrick Gold Corp.	8.4 Moz Au (ID)
37 Newfoundland	E	Block 103	Fe	Cap-Ex Ventures Ltd.	2,100 Mt Fe (IF)	89 Nevada	F	Pumpkin Hollow	Cu, Au, Ag	Nevada Copper Corp.	1.9 Mt Cu, 900,000 oz Au, 27
38 Newfoundland	E	Valentine Lake	Au	Marathon Gold Corp.	680,000 oz Au (D)	90 Nevada	E	Spring Valley	Au	Barrick Gold Corp.	2.1 Moz Au (D)
39 Nunavut	E	Angilak	U ₃ O ₈ , Mo, Cu, Ag	Kivalliq Energy Corp.	12 kt U ₃ O ₈ , 2.8 kt Mo, 4.4 kt Cu, 932,000 oz Ag (IF)	91 Nevada	P	Turquoise Ridge	Au	Barrick Gold Corp.	7 Moz Au (R)
40 Nunavut	E	Back River	Au	Sabina Gold & Silver Corp.	4.2 Moz Au (D)	92 Texas	D	Goliad	U ₃ O ₈	Uranium Energy Corp.	1.7 kt U ₃ O ₈ (D)
41 Nunavut	E	Meliadine West	Au	Agnico-Eagle Mines Ltd.	2.9 Moz Au (R)	93 Wyoming	E	Bear Lodge	REE	Rare Element Resources Ltd.	224 kt REO (R)
42 Ontario	P	Black Fox/Grey Fox	Au	Brigus Gold Corp.	840,000 oz Au (R)	94 Azerbaijan	P	Gedabek	Au, Cu, Ag	Anglo Asian Mining plc.	744,000 oz Au, 60 kt Cu, 6 Moz Ag (R)
43 Ontario	E	Cote Lake	Au	Iamgold Corp.	7.6 Moz Au (ID)	95 China	P	Jiama	Cu, Au, Ag, Mo, Pb	China Gold Int'l. Resources Corp.	2.8 Mt Cu, 2.6 Moz Au, 138 Moz Ag, 109, kt Mo, 94.5 kt Pb (R)
44 Ontario	E	Golden Bear	Au	Northern Gold Mining Inc.	1.3 Moz Au (D)	96 China	P	Ying	Ag, Pb, Zn, Au	Silvercorp Metals Inc.	79 Moz Ag, 396 kt Pb, 137 kt Zn, 19,000 oz Au (R)
45 Ontario	E	Magino	Au	Argonaut Gold Inc.	6.2 Moz Au (ID)	97 Mongolia	E	Mandal Moly	Mo, W	Moly World Ltd.	250 kt Mo, 51.5 kt W (D)
46 Ontario	E	Phoenix	Au	Rubicon Minerals Corp.	480,000 oz Au (ID)	98 Mongolia	E	Selenge	Fe	Haranga Resources Ltd.	8 Mt Fe (IF)
47 Ontario	F	Rainy River	Au, Ag	Rainy River Resources Ltd.	6.2 Moz Au, 13 Moz Ag (D)	99 Portugal	P	Neves Corvo	Cu, Zn, Ag, Pb	Lundin Mining Corp.	815 kt Cu, 1.9 Mt Zn, 82 Moz Ag, 434 kt Pb (R) Moz Ag (D)
48 Ontario	E	Springpole	Au, Ag	Gold Canyon Resources Inc.	4.4 Moz Au, 23 Moz Ag (ID)	100 Turkey	P	Copler	Au, Cu, Ag	Alacer Gold Corp.	4.3 Moz Au, 102 kt Cu, 13 Moz Ag (R)
49 Ontario	P	Thunder Creek	Au	Lake Shore Gold Corp.	418,000 oz Au (PR)						
50 Ontario	E	Upper Beaver	Au, Cu	Queenston Mining Inc.	1.5 Moz Au, 25 kt Cu (ID)						
51 Quebec	E	Akasaba	Au	Alexandria Minerals Corp.	254,000 oz Au (ID)						
52 Quebec	E	Comtois	Au	Maudore Minerals Ltd.	544,000 oz Au (ID)						
53 Quebec	E	Duncan Lake	Fe	Augyva Mining Resources Inc.	256 Mt Fe (D)						

² Resource estimate for primary product or coproducts derived from various 2010 sources: D=measured + indicated, ID=indicated, IF=inferred, R=proven + probable, P= proven, PR=probable. Data were not verified by the U.S. Geological Survey. ³ Although resource data have not been released, the site was considered noteworthy by the authors based on the level of exploration activity or regional significance. ⁴ REE - Rare earth elements.

is looking at global investment opportunities for copper, iron ore, nickel and uranium. Since 2009, Chinese investors have focused mineral investment in Africa, Southeast Asia, Australia, Canada, Latin America and the United States. Chinese investment in the United States has increased from about \$1 billion in 2008 to \$7.7 billion in 2012. Even with the slowdown in Chinese industrialization as a result of the downturn in the global economy, China continues to look overseas, purchasing companies or taking stakes in mines or projects in Africa, Australia and the Pacific region.

Many exploration projects are becoming increasingly more costly and difficult to develop. Therefore, expanding supply is likely to shift future production to more challenging environments. Cost drivers include more complex orebodies, deeper lying deposits often with lower grades and more remote locations. Higher commodity prices in combination with the increasing difficulty of finding significant new resources in traditionally productive areas have encouraged some exploration companies to evaluate mineral resources in more remote areas. The Canadian

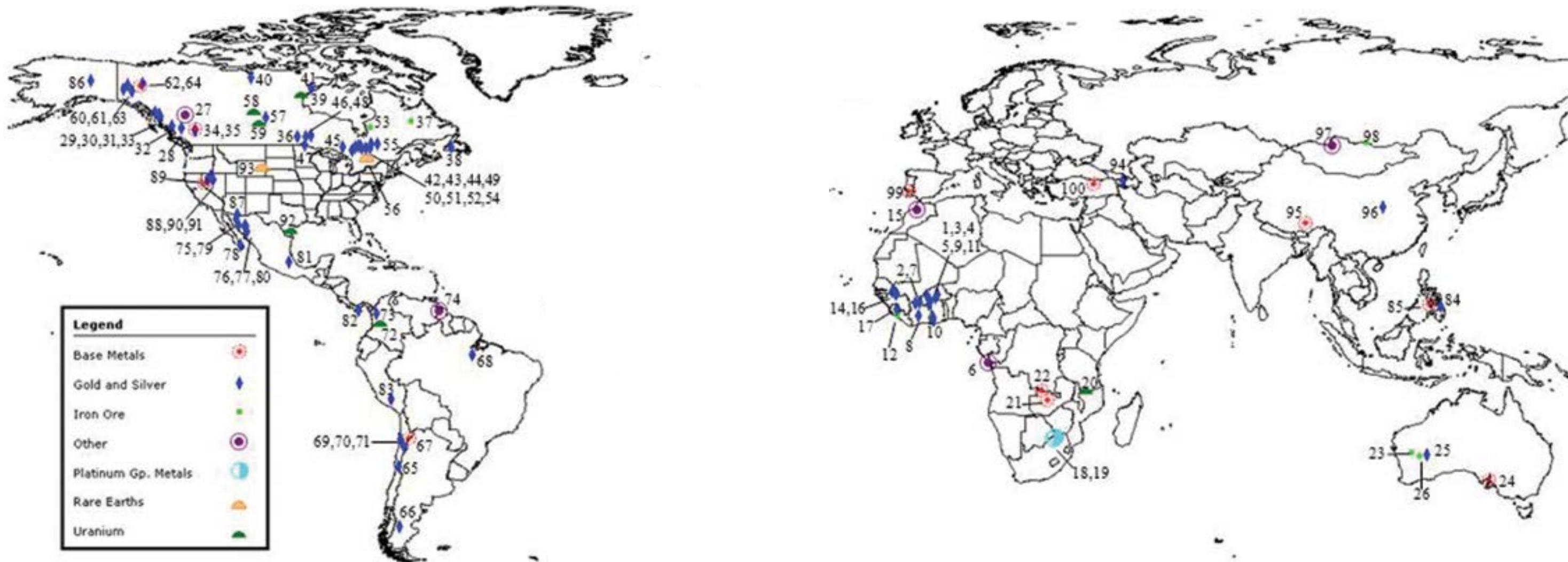
Arctic and the high mountains of South America are two areas receiving interest by exploration companies.

Seabed ore deposits are attractive because they generally contain higher concentrations of certain metals than many onshore deposits; however, commercial extraction will likely be expensive and environmental issues may be challenging. In 2007, Nautilus Minerals began exploration for massive sulfides off the coast of Papua New Guinea. In 2011, the company was granted a 20-year mining lease for the property. However, activities were halted in

2012 when the government imposed a temporary ban on seabed mining while an assessment of possible environmental consequences of seabed mining was conducted. The International Seabed Authority, an autonomous international organization established under 1994 provisions of the United Nations Convention on the Law of the Sea, approved four applications by interests from China, Nauru, Russia and Tonga to explore for sulfides and iron ore deposits in international areas of the deep-sea floor, but stipulated that the appropriate legal framework must be in place

Figure 6

Map showing locations of the 100 noteworthy sites and their principal commodity. Figures reflect site numbers as shown in Table 2.



Exploration budgets for base metal projects increased 21 percent to \$6.4 billion in 2012 from \$5.3 billion in 2011 based on MEG data. In terms of percentage of total worldwide exploration budgets, the estimated base metal exploration budget increased slightly to 33 percent in 2011 if uranium and iron ore are not included.

before work can commence. Eight other groups have laid claim to areas in international waters in both the Indian and Pacific oceans for nickel-bearing nodules. Prospecting of diamond and phosphate occurrences in shallow waters offshore of Namibia was continuing. The Japan Agency for Marine-Earth Science and Technology plans to explore the water around Minami-Torishima Island in the Sea of Japan for rare earth deposits. Scientists from India's Science, Technology, and Earth Sciences Ministry are investigating the economic potential of mining polymetallic nodules for nickel, copper, cobalt and manganese in the Indian Ocean. Sudan and Saudi Arabia are jointly exploring the coast of the Red Sea for copper and precious metals.

Exploration activity by mineral commodity

The amount budgeted for gold exploration (\$9.7 billion) based on MEG data for 2012 is 17 percent higher than that budgeted for gold in 2011. Figure 5 illustrates the 2008-2012 distribution of reported mineral exploration budget estimates by mineral commodity grouping (excluding uranium). Figure 5 shows that the amount budgeted for gold exploration targets increased as a percentage of the total exploration budget for the years 2008 through 2010 and remained about the same from 2010 through 2012. In terms of percentage of worldwide exploration budget, exploration for gold accounted for 49 percent in 2012 and 51 percent in 2011 (when uranium and iron ore are excluded). The budget for gold exploration in Australia, Canada and the United States accounted for about 36 percent (\$3.6 billion) of the gold exploration budget. Exploration for gold in Brazil, Burkina Faso, Chile, China, Colombia, Ghana, Indonesia, Mexico, Peru and Russia accounted for an additional 36 percent of the 2012 gold exploration budget.

Exploration budgets for base-metal projects increased 21 percent to \$6.4 billion in 2012 from \$5.3 billion in 2011 based on MEG data. In terms of percentage of total worldwide exploration budget, the estimated base metal exploration budget increased slightly to 33 percent in 2011 if uranium and iron ore are not included. As shown in Fig. 5, the general trend for base-metal exploration for 2007 through 2012 was the reciprocal of gold exploration. When expressed in terms of percentage of worldwide budget, base-metal exploration decreased from 2008 through 2010, and remained stable during 2011 and 2012. Exploration for copper accounted for 73.5 percent of the base-metal budget for 2011, zinc exploration accounted for 13.5 percent and nickel exploration accounted for 13 percent. The budget share for nickel in 2012 represented the smallest share

reported by MEG in the last 20 years.

The budget for diamond exploration estimated by MEG increased 16 percent in 2012 in nominal dollar terms from 2011. In nominal dollar terms, the diamond exploration budget of about \$520 million in 2012 was about half of the budget for diamond in 2008 and represented about 2.5 percent of the global exploration budget, its lowest share since MEG began compiling data in 1989. Principal locations for diamond exploration in 2012 were Africa and Canada. Decreased diamond sales, increased international concern over illegal diamond mining and energy shortages in South Africa may have contributed to the lower level of diamond exploration.

Based on the MEG estimated 2012 budget for PGM exploration, the 2012 estimate of \$312 million was up 30 percent from the 2011 budget estimate of \$240 million, although the MEG allocation for PGM in 2012 was 1.5 percent of the total global mineral exploration budget in 2012, about the same as it was for 2011. Principal areas for planned PGM exploration in 2011 were Africa (53 percent, primarily South Africa and Zimbabwe), Rest of the World (25 percent, including China, Finland, India, Mongolia, Russia and Sweden) and North America (22 percent).

Based on MEG data, the estimated 2012 global budget for mineral commodity targets other than base metals, diamond, iron ore, PGM and uranium was 32 percent higher (\$2.8 billion) in 2012 from the \$2.1 billion reported for 2011. Silver accounted for 31 percent of the total, potash and phosphates accounted for more than 27 percent, followed by lithium and rare earth elements at almost 14 percent. Exploration for lithium, potash and rare earths has increased as demand for high-tech applications has risen. Concern about export quotas of China's rare-earth elements has led to increased exploration for these commodities and fast-tracked development of production facilities in other countries.

The budget estimate for uranium exploration reported by MEG decreased from about \$938 million in 2011 to about \$873 million in 2012, perhaps one consequence of the 2011 earthquake and tsunami event in Japan at the Fukushima Daiichi nuclear power plant. MEG included estimates for the global iron ore exploration budget for the first time in 2011. MEG estimated the 2012 iron ore exploration budget increased 50 percent to almost \$2.8 billion in 2012 from \$1.8 billion in 2011 owing to increased interest by Chinese investors. Iron ore exploration in Australia accounted for 45 percent, Brazil accounted for 14 percent and Canada accounted for about 7 percent of the global total exploration budget for iron ore in 2012.

Table 3

Noteworthy exploration projects¹ by region for the years 2002-2012.

Region	2002 ²	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Africa	16	16	20	18	21	19	24	22	13	23	22
Australia	20	10	4	10	6	6	10	13	5	6	4
Canada	19	31	28	22	24	25	26	26	33	31	38
Latin America ³	15	19	21	29	25	25	17	16	29	20	19
Pacific ⁴	4	4	4	4	4	3	3	7	1	2	2
United States	6	12	12	4	6	8	8	7	9	9	8
Rest of the world ⁵	10	8	14	13	14	14	12	9	10	9	7

¹ Based on data developed by the USGS and appearing in Table 2 of the exploration summary discussion published in the May issue of *Mining Engineering* for the years 2003-2013.
² Only 90 noteworthy exploration projects met the selection criteria for 2002.
³ Including Central America, Mexico and South America.
⁴ Including Southeast Asia and islands in the Pacific Ocean.
⁵ Including China, the Commonwealth of Independent States, Europe, India, the Middle East, Mongolia and Pakistan.

Based on global exploration site data compiled by the USGS, exploration for gold and silver accounted for about 54 percent of the active exploration sites in 2012. Base-metal exploration accounted for about 21 percent of the 2012 active exploration sites, iron ore accounted for about 8 percent, uranium accounted for about 3 percent, platinum-group metals about 2 percent and diamond about 1 percent. Exploration for other mineral commodities accounted for about 11 percent. Both the MEG and USGS data support the trend that there is increasing interest in exploration for lithium, potash and rare-earth elements because of the increased use of lithium for batteries, potash for fertilizers and biofuels, and rare-earth elements for electronics.

2012 exploration highlights

Table 2 presents exploration sites considered most noteworthy by the authors based on the amount of exploration activity conducted at the sites in 2012. An estimated 5.4 Mm (17.7 million ft) of drilling took place on the 100 sites included in Table 2. The following criteria were used as a basis for site inclusion:

- The high level of exploration interest at a site, determined either by intensity of drilling activity or level of capital investment. When drilling was used as the principal indicator, a site qualified if a minimum of 20,000 m (65,600 ft) of drilling (primarily diamond or reverse-circulation) took place during 2012; where budget was used as the principal indicator, a site qualified if a 2012 budget of at least \$7 million was planned and executed for exploration and drilling activities. These criteria may eliminate early-stage projects (where the level of drilling was below

cutoff) or development projects (where planned expenditures include costs for development or infrastructure).

- The magnitude of resource delineated when compared to prior resource estimates.
- The high potential of near-term development, based upon reported tonnage and grade estimates derived from company announcements.
- The regional significance of an activity.
- The project reflects an emerging source of mineral supply as a result of advances in extraction technology.

Sites where significant exploration activity and expenditures occurred prior to 2012 were not included in Table 2 if the reported level of 2011 activity did not meet the selection criteria. Similar criteria have been applied to previous exploration summaries reported annually in the *USGS Minerals Yearbook* series and in exploration summary articles reported in *Mining Engineering*.

Gold continued to be the commodity generating the greatest exploration activity based on the list of noteworthy exploration sites for 2012 as reported in Table 2. Of the 100 sites selected for Table 2, gold or silver was considered the primary mineral commodity at 66 sites, base metals were considered primary at 12 sites, uranium was the primary target at six sites, iron ore was the primary target at six sites, rare-earth elements were the primary target at two sites, platinum-group metals were the primary target at two sites, and manganese, molybdenum, niobium, phosphate and tin were the primary targets at the remaining six sites. Determination of the primary commodity was based on consideration of commodity value and contained resources at each site.

The estimated resources reported in

Latin American countries with the greatest exploration activity, in descending order by number of sites for which data were compiled, were Mexico, Peru, Brazil, Chile, Argentina and Colombia.

Table 2 reflect various stages of verification, different methodologies and multiple sources of information. Should these resources be confirmed, however, they would add about 3.2 Gt (3.5 billion st) of iron, 53 Mt (58 million st) of phosphate, 37 Mt (41 million st) of copper, about 3 Mt (3.3 million st) of lead and zinc, 1 Mt (1.1 million st) each of nickel and niobium oxide (Nb₂O₃), 750 kt (826,000 st) of molybdenum, 300 kt (330,000 st) of rare-earth oxide (REO), 160 kt (176,000 st) of zirconium oxide (ZrO₂), 73 kt (80,000 st) of uranium, 52 kt (57,000 st) of tungsten, 42 kt (46,000 st) of tin, 39 kt (1.2 billion oz) of silver, 6.4 kt (200 million oz) of gold, 1.2 kt (38 million oz) of PGM, 5.8 kt (6,400 st) of tantalum oxide (Ta₂O₅) and 2.4 kt (2,600 st) of vanadium to the identified world resources for these mineral commodities estimated by the USGS.

Figure 6 plots the locations of those sites included in Table 2. Site numbers shown in Table 2 are reflected in Fig. 6 to allow the reader to identify each site. Sites have been classified by their primary commodity target.

Table 3 shows the number of noteworthy sites by region for the years 2002 through 2012. In terms of noteworthy projects identified for 2012, the number of projects in Canada increased relative to the number reported for 2011 in those regions, and the number of noteworthy projects in Australia decreased. There was limited change in the number of significant projects reported for other regions.

In an economic climate of high metals prices but increasingly limited government revenues, some countries, states or municipalities have expressed interest in obtaining greater revenue from minerals and mining by increasing taxes and/or royalty rates or by imposing additional controls on foreign investment within their jurisdictions. Other areas were in the midst of ongoing social unrest or increased environmental pressures to regulate or restrict mining and mineral exploration. As a result, the perceived “risk” profiles of many jurisdictions changed from 2011 to 2012.

The Fraser Institute of British Columbia, Canada, annually publishes a survey assessing the effects of perceived “mineral potential” and public policy on exploration investment around the world. The 2012-2013 survey (published February 2013) includes data from 742 respondent companies, representing 30 percent of the total global nonferrous exploration budget (when uranium is excluded) as reported by MEG.

According to the March 2013 Fraser Institute survey, the top 10 destinations for mineral exploration based on favorable mineral policies in 2012, listed in descending order, were Finland, Sweden, Alberta (Canada), New Brunswick

(Canada), Wyoming (United States), Ireland, Nevada (United States), Yukon Territory (Canada) and Norway. The top 10 destinations for mineral exploration based on their prospecting potential, assuming 2012 regulations and land use restrictions and listed in descending order, were Greenland, Finland, Sweden, Nevada (United States), Saskatchewan (Canada), Alaska (United States), Yukon Territory (Canada), Wyoming (United States), Western Australia (Australia) and Northern Territory (Australia).

Exploration activity and related legislation by region

A summary of exploration-related activities and events within each region follows. The order of regional and country discussions is based on the amount budgeted for exploration in 2012 from highest to lowest. Areas not included in the regions discussed have been aggregated as “Rest of the World” and are discussed separately at the end of this section.

Latin America. Latin America continued its leading position as a destination for exploration activity based on MEG budget data since 1994, but was listed second after Canada by the USGS when the number of active sites was considered. MEG estimated that the 2012 exploration budget for Latin America increased 24 percent to about \$5.2 billion from the \$4.2 billion estimated for 2011. Recent discoveries high in the Andes Mountains of Argentina and Chile have focused exploration in an area where exploration costs are relatively high due to the remoteness of the area. Argentina, Brazil, Chile, Mexico and Peru were ranked in MEG’s top 10 country list for anticipated exploration spending in 2012. On the basis of data compiled for this review by the USGS, Latin American countries with the greatest exploration activity, in descending order by number of sites for which data were compiled, were Mexico, Peru, Brazil, Chile, Argentina and Colombia. Approximately 60 percent of the deposits explored in 2012 in Latin America contained gold or silver and 39 percent contained base metals, based on the sites considered in the USGS compilation. Activity in 2012 was primarily used to further define early-stage resources (74 percent), conduct exploration at a producing site (16 percent), conduct feasibility studies of promising discoveries (6 percent) and further explore for resources of deposits under development (4 percent).

Figure 7 illustrates exploration activity in terms of budget allocation and the number of active exploration sites. Data in Fig. 7 are expressed as a percentage of world activity based on budget allocation share reported by MEG and the number

of sites as compiled by the USGS from various sources. Exploration activity in Latin America during 2012 continued a trend of increasing exploration activity as measured by the number of active sites, but showed a slight decrease in activity relative to other regions based on the exploration budget allocation. In 2012, there was increasing political and social pressure on exploration and mining activities in some Latin American countries such as Argentina, Bolivia, Peru and Venezuela, reducing activity in these countries. In other countries, Latin America was still considered a leading region for mineral exploration owing to promising geology, the perception of its mineral policies, and its successful historical record of mineral production and development. Thus, although its percent of global share dropped in 2012, the exploration budget for Latin America showed an overall increase in 2012. The Latin American region has generally been able to maintain its global share of exploration sites for the past decade, suggesting that exploration companies have continued to favor this region even during lean economic conditions or when nationalism of resources in some countries has led to increased risk of resource development.

The Argentinean Supreme Court of Justice lifted the suspension of National Law 26.639 for the Protection of Glaciers and Periglacial Environments, passed in 2010 that protected glacial environments from openpit mining. As a result of a requirement to inventory all glaciers and periglacial areas in the country, the projected 2013 completion of construction at Pascua-Lama may be delayed, and other mineral exploration in the region may be limited. The Argentinian government repealed laws banning the use of cyanide in gold mining and processing.

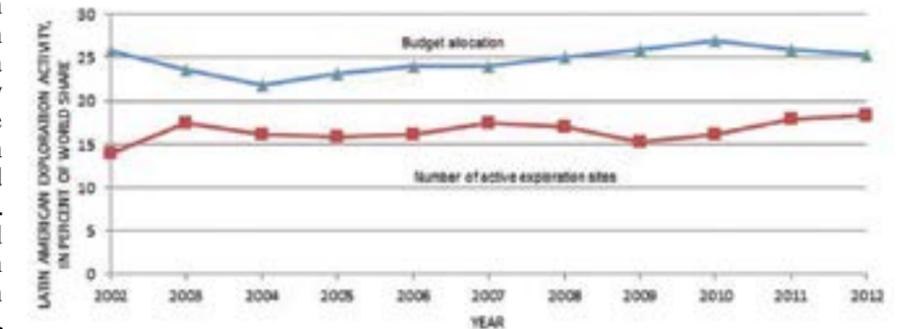
Bolivia passed legislation entitled the “Law of Mother Earth,” which redefines mineral deposits as “blessings.” The legislation assigns 11 rights to nature (including natural ore deposits), which are likely to limit mining, infrastructure, and development projects that are determined to affect ecosystem balance and the local inhabitant communities.

Brazil passed legislation allowing the use of mercury in gold mining if a permit is obtained and documentation is provided attesting the origin of the mercury within 30 days of the issuance of environmental permit. Minerals receiving a sizable amount of exploration investment in Brazil between 2011 and 2015 include bauxite, copper, gold, iron ore, nickel, phosphate and potash.

The Chilean government created a \$US150-

Figure 7

Exploration activity and budget for Latin America, 2002 through 2012. Sources: SNL Metals Economics Group; U.S. Geological Survey.



million exploration fund to provide funding for selected exploration projects.

A mining exploitation agreement was signed between the government of Ecuador and Chinese-owned Ecuacorriente setting terms for the exploration and development of the El Mirador copper project.

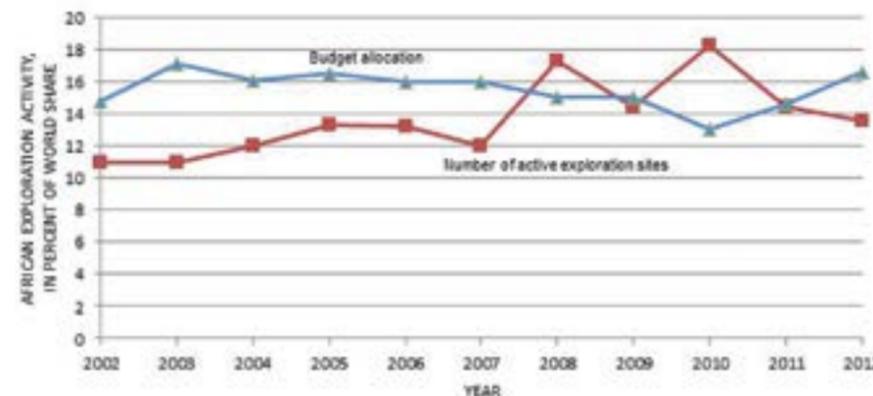
Peru has seen an influx of mineral investment in recent years. But, despite this investment, social conflicts in rural areas of Peru have increased by 300 percent during the past five years. A 2011 law requiring mining and oil companies to consult with indigenous communities before developing a project may renew social activism. Recent unrest has reportedly contributed to delays or postponements in 15 large and mid-size mining projects, and 135 more projects have been held up by the new environmental consultation requirements, causing permitting delays.

After nationalization of the Venezuelan gold mining industry was formalized in 2011, the only foreign mining company active in Venezuela is the China International Trust and Investment Corporation (CITIC), contracted to explore and develop the Las Cristinas gold mine. Venezuela expropriated the Las Cristinas project from the Canadian company Crystallex International Corp. in February and the mining assets of Rusoro Mining Ltd, which had been until recently the only foreign gold miner in Venezuela. Both companies have filed for arbitration with the World Bank, claiming they are entitled to financial reimbursement for assets that were expropriated.

Africa. According to MEG, African exploration budgets increased to about \$3.4 billion in 2012 from about \$2.4 billion in 2011, a 44-percent increase. Based on site data compiled by the USGS, active gold and silver projects in 2012 accounted for approximately 50 percent of the reported African exploration projects, base-metal projects accounted for about 15 percent, iron ore projects accounted for about 10 percent, PGM projects accounted for about 7 percent,

Figure 8

Exploration activity and budget for Africa, 2002 through 2012. Sources: SNL Metals Economics Group; U.S. Geological Survey.



uranium projects accounted for about 6 percent, diamond projects made up about 3 percent and other minerals accounted for the remaining 9 percent. Early-stage projects comprised about 69 percent of the 2012 activity, while producing projects accounted for about 17 percent, feasibility stage projects represented about 10 percent and developing projects accounted for about 4 percent. Exploration was focused primarily in South Africa, Burkina Faso, Ghana, Tanzania, Namibia, Congo (Kinshasa), Mali, Guinea and Botswana, in descending order based on the number of sites. But activity also took place in a number of other countries.

African exploration activity, as shown in Fig. 8 expressed in terms of percent of world share of budget and number of active sites, has been quite variable since 2007. Prior to 2007, the percent share of active sites was low when compared to the African budget allocation, suggesting that much of the activity was focused on advanced sites where exploration tends to be more expensive. After 2007, however, the number of early-stage sites increased, likely a result of increased interest by Chinese and Indian companies in the region. The decrease in site activity in 2008 is likely a result of the global economy. The decrease in number of sites being explored since 2010 is possibly tied to increasing resource nationalism in some African countries, which has the potential to make foreign investment in such countries more risky. Chinese mining investment in Africa increased from \$1.5 billion in 2010 to \$15.6 billion in 2011, about 75 percent of Chinese foreign mining investment. This investment was driven mainly by seven large successful joint-venture projects undertaken in 2011, accounting for 94 percent of total Chinese investment in Africa. Increasingly, Chinese companies have developed off-take agreements with foreign miners in return for investment. African investment by the Chinese was expected to continue into 2012, reflected in Fig. 8 by the

increase in exploration budget and the number of active African exploration sites reported for 2012.

Exploration activity in Africa in 2012 varied as improving commodity prices and renewed investor interest stimulated activity in some areas while mineral supply concerns related to labor issues and regional unrest have limited activity in other areas. Issues of concern include artisanal mining, conflict minerals, employment, government pressures and political instability. Mining-related tax increases have been initiated in Burkina Faso, the Democratic Republic of Congo, Guinea and Senegal, and proposed by Cote d'Ivoire and Ghana.

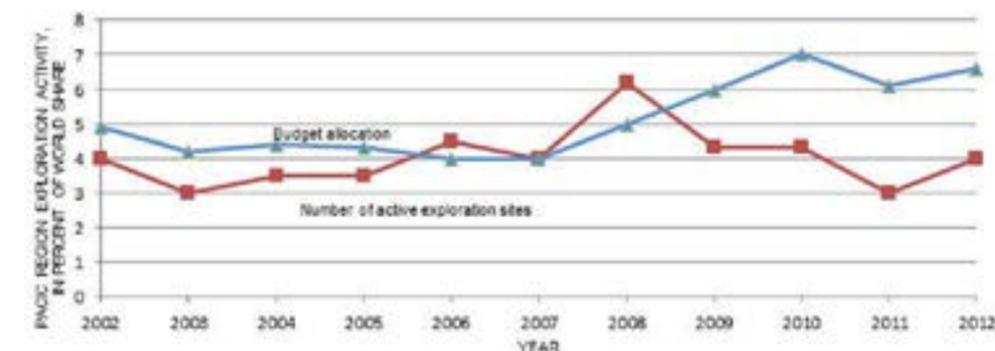
Interest in exploring for African mineral resources continues to increase. Australian companies are involved in 650 projects in 37 African countries, and agreement has been reached to spend A\$5 (US\$4.8) million over the next two years to establish an African minerals development center with plans to invest A\$200 (US\$190) million between 2011 and 2015 in mining projects. The International Finance Corp. intends to invest \$300 million in mining companies operating in Africa between 2011 and 2013. China and India are investing in natural resource projects in Africa. A survey of institutional investors conducted by the Economist Intelligence Unit found that two-thirds of the respondents listed Africa as having the greatest opportunity for investment of global frontier markets in spite of its macroeconomic and political risk.

As focus on African resources increases, so, too, does resource nationalism and conflict generated by groups interested in securing a portion of the wealth generated by mining in light of higher metals prices. In the Democratic Republic of the Congo, renewed fighting in the eastern provinces make mining and conflict minerals enforcement difficult as almost 90 percent of the gold mining in the country comes from artisan miners. Mineral development in the country is made more expensive as transportation networks have been damaged or left to deteriorate following years of conflict. In Burkina Faso, the third most explored area of Africa, increasing activity by militant groups has limited exploration and mining activities. A military coup in Mali and rebel activity in its northern provinces has also influenced mineral exploration in the country.

Interest in mineral exploration has increased in Ethiopia, where the Ministry of Mines granted 72 exploration licenses, of which 18 were for potash exploration. The government is financing power and transportation infrastructure improvements to

Figure 9

Exploration activity and budget for the Pacific Region, 2002 through 2012. Sources: Metals Economics Group; U.S. Geological Survey.



support mine development.

Notable legislative activities in other African countries that took place in 2012 include the launching of Project 2050 by the government of Namibia, a \$322 million project over five years designed to develop coastal mining projects by creating artificial shore lines to allow for mining. In Mauritania, a New Model Mining Convention Law was passed in 2012 to provide a consistent framework for implementing the 2008 Mining Code, including an amendment to the Mining Code that sets new royalty rates for copper, gold and iron ore. The Office Chérifien des Phosphates, a government-controlled company in Morocco, plans to invest \$5 billion during the next decade to develop infrastructure for new domestic mines, beneficiation facilities and pelletizing plants.

South Africa's mining industry faced a number of challenges, including aging infrastructure, increasing energy and labor costs, labor disputes, safety issues and technical constraints. Factors leading to a decline in mineral exploration include lack of detailed and updated geological maps, limited access to local risk capital, and uncertainty of legislation and mineral policies. The platinum industry in South Africa has seen an electricity price increase of 258 percent since 2007, and the gold industry has seen an electricity price increase of 143 percent since 2007. In 2012, labor unrest in the gold and PGM sectors led to higher labor costs, lower productivity, and reduced production levels. Gold production continued to decline; the gold production level in 2012 was more than half of its level in 2000.

In South Sudan, which became independent in 2011, the National Assembly passed a mining bill that gives states the ability to administer the exploration and mining of minerals in their territories. The Zimbabwe government approved a policy prohibiting the export of uncut or unpolished diamonds, and plans to implement nationalization of the country's diamond industry.

Canada. Statistics as of September 2012 and released by the Canadian government, show 2012 exploration spending expenditures through the feasibility level at \$4.1 billion, down 3 percent from \$4.2 billion for 2011. MEG reported budgeted exploration spending in Canada for 2011 at \$3.2 billion, or about 16 percent of the estimated overall worldwide exploration budget. Canadian

government statistics include planned exploration expenditures for a wider variety of minerals and materials than are included in the MEG estimates. It is also important to note that the total of revised spending intentions for Canada reported by Natural Resources Canada as of September was higher than its March 2012 estimate of \$4.2 billion, although these adjusted figures may reflect increased exploration costs rather than a greater amount of exploration activity. In 2011, precious metals (gold and silver) accounted for \$2.3 billion; base metals, \$730 million; uranium, \$198 million and diamond, \$92 million of the \$4.2 billion exploration total. When the Canadian exploration statistics are reconfigured to make them comparable with MEG statistics, the reported exploration expenditures as of October 2011 by Natural Resources Canada would be \$3.1 billion, essentially equivalent to the MEG estimate.

Company exploration spending for 2012, as reported by the Canadian government as of January 2013, was greatest in Ontario (24 percent of the total exploration and deposit appraisal expenditures for Canada), Quebec (19 percent), British Columbia (18 percent), Nunavut (10 percent), Saskatchewan (7.9 percent) and Yukon Territory (7.1 percent). Canadian provinces or territories with a 15-percent or more increase in exploration activity in 2012 from 2011 based on reported expenditures were Nova Scotia (55 percent increase, primarily a result of exploration for gold and base metals), Northwest Territories (44 percent increase, primarily a result of precious and base metals, diamond and rare-earth exploration), British Columbia (17 percent increase, primarily a result of exploration for base and precious metals), and Newfoundland and Labrador (165 percent increase, primarily a result of increased exploration for base and precious metals, iron ore and rare earths). Nunavut had a 20-percent decrease in budgeted exploration expenditure in 2012 from 2011, although Ontario had the largest decrease in total exploration



Despite volatility in metal prices, industry confidence was sufficiently strong enough to support a variety of exploration programs in 2012.

budget from \$1.1 billion in 2011 to \$990 million in 2012. Junior exploration companies accounted for about 54 percent of total expenditure in 2012, down from 57 percent in 2011. In terms of mineral commodities sought country-wide, precious metals received the largest exploration expenditure (54 percent), followed by base metals (17 percent), uranium (5 percent) and diamond (2 percent) in 2011. Coal, iron ore and other minerals comprised the remaining 22 percent.

Canadian provinces or territories with the greatest exploration activity, in descending order by number of sites in 2012 as compiled by the USGS, were Quebec, Ontario, British Columbia, Yukon Territory, Saskatchewan, Newfoundland and Labrador, Nunavut and Manitoba. Based on the site data, 58 percent of the Canadian exploration sites targeted precious metals, 26 percent base metals, 7 percent iron ore, 4 percent rare-earth elements, 3 percent uranium and 2 percent of the sites targeted graphite, lithium or potash. There was an increase in exploration for graphite, lithium, potash and rare-earth elements in 2012. Approximately 87 percent of all reported exploration sites were considered early-stage sites.

Although the mineral exploration budget in 2012 in Canada increased slightly from 2011, the rate of increase was lower than in previous years, reflecting a reduction in the number of junior companies conducting exploration in Canada, while explorers with more advanced projects planned to increase spending in 2012. Changes in mining rules in Ontario requiring consultation and

the submission of exploration and mining plans to native groups prior to activity are thought to have contributed to reduced growth in Canada by increasing exploration costs and delaying initiation of activities. Canada has experienced little growth or gradual decline in exploration budget percent allocation (relative to other parts of the world) and number of active sites since 2003.

Much of Canada's legislation in 2011 and 2012 was aimed at stimulating the country's economy. The 2012 federal budget included provisions to extend the temporary 15 percent Mineral Exploration Tax Credit for another year to March 2013, and set up a one-project, one-review system of reviewing major projects. The Canadian government allocated C\$25 million over a five-year period to renew the Targeted Geoscience Initiative, with a focus on developing new methods for exploring deeper mineral deposits, and the five-year, \$100 million Geo-mapping for Energy and Minerals (GEM) program. The Canadian Northern Economic Development Agency plans to invest \$3.275 million over three years (2012 through 2014) to support geoscience research and data analysis in the Northwest Territories.

At the provincial level, the Pacific Gateway Transportation Strategy 2012-2020 was initiated by the British Columbia government to improve trade with Asia by improving transportation infrastructure in the province. The 2012 budget for Nova Scotia set aside \$700,000 in grant money to promote mineral prospecting. The Ontario government initiated rules requiring explorers to consult with aboriginal groups before initial exploration activities can proceed.

Although Nunavut territory has received much interest in recent years by exploration companies, successfully developing a mineral resource into a viable mine has proven to be challenging. Nunavut's climate and lack of infrastructure have increased exploration and mining costs, and have provided challenges to finding qualified personnel and technical processes. Higher-than-expected costs have resulted in a change in mine plan for the newly-opened Meadowbank gold mine and suspension of development activities at the Hope Bay gold property.

Australia. Exploration budget allocations reported by MEG for Australia showed an increase to about \$2.5 billion in 2012 from \$2 billion in 2011. The Australian Bureau of Statistics reported mineral exploration expenditures (excluding petroleum) for its fiscal year from July 2011 through June 2012 of about A\$4 billion (US\$4.1 billion), a 57-percent increase from the Australian expenditure for fiscal year 2010-2011. The Western Australia Department of Mines and Petroleum

reported that the number of prospecting licenses in Western Australia increased about 3.5 percent from its fiscal year 2010-2011 to fiscal year 2011-2012, and the number of exploration licenses increased 15 percent from fiscal year 2010-2011 to fiscal year 2011-2012. The Australian statistics include expenditures for a greater number of mineral commodities than do the MEG statistics.

The estimated expenditures for iron ore exploration in Australia accounted for 37 percent of the total Australian expenditure for metals and minerals for fiscal year 2011-2012 (excluding coal and petroleum), compared to 27 percent for 2010-2011, based on data reported by the Australian Bureau of Statistics as of Nov. 30, 2012. Gold exploration accounted for about 25 percent of the total Australian expenditure for metals and minerals for fiscal year 2010-2011 and 27 percent in 2010-2011. In nominal terms, gold exploration increased about 18 percent in fiscal year 2011-2012 to A\$768 million (\$795 million). Base metals accounted for 26 percent of the total Australian expenditure in fiscal 2011-2012, compared to 28 percent in 2010-2011. The estimated expenditure for base metals exploration increased 19 percent to A\$796 million (\$824 million) in fiscal year 2011-2012. Western Australia's share of the Australian mineral exploration expenditure (excluding coal and petroleum) accounted for 68 percent; Queensland accounted for about 8 percent; South Australia accounted for about 10 percent; Northern Territory accounted for 7 percent; New South Wales accounted for 4 percent; Victoria accounted for 2 percent and Tasmania accounted for 1 percent.

During fiscal year 2011-2012, exploration companies drilled a total of 11.4 Mm (37.4 million ft) in Australia, compared to 9.7 Mt (31.8 million ft) in 2010-2011. Of this drilling, 67 percent was for greenfield projects and 33 percent was for brownfield projects. The greenfield project share has decreased from about 45 percent in 2003 to 33 percent in 2011. As commodity prices have increased, companies have focused their efforts in expanding reserves at known and producing projects. Such a trend suggests that less drilling is being performed in areas with limited historical exploration.

Although exploration expenditures increased from 2010-2011 to 2011-2012, 75 percent of Australian resource company executives were concerned that mining in Australia was more complicated and costly owing to such factors as increasing regulatory obligations, uncertain development requirements and rising costs. During 2011, a number of laws were enacted by the Australian Parliament. Effective July 2012, a carbon tax of A\$23/t (\$25/st) of carbon was

imposed on 500 companies having the largest carbon emission rates. Legislation was enacted in July 2012 that will expand the definition for minerals exploration to include geothermal energy sources and was provide a tax deduction for these minerals that is available for other minerals under current law. A 30-percent minerals resource rent tax came into effect in 2012 and applies to all new and existing iron ore and coal projects in Australia. In 2012, 56 percent of funds raised by Australian companies for minerals exploration was targeted for overseas projects.

Western Australia's Department of Mines and Petroleum reported that the number of new exploration permit applications decreased by about 200 in the fourth quarter of 2012 compared to the preceding quarter. The department attributed this decrease to high operating costs in Western Australia.

The Queensland government announced plans to allow the restart of uranium mining in the state, and convened an implementation panel to oversee the process. The Western Australian government established a mining exemption area around the Horizontal Falls tourist site.

United States. The U.S. nonfuel mineral exploration budget was anticipated to increase by about 23 percent to about \$1.7 billion in 2012 from \$1.4 billion in 2011, according to MEG data. The U.S. percentage of the world exploration budget remained at 8 percent in 2011. The increase in the U.S. minerals exploration budget in 2011 is tied to an improved economy, higher commodity prices and higher exploration costs.

In 2012, data on 334 U.S. exploration projects were collected and reviewed by the USGS; 35 percent were located in Nevada, 13 percent in Alaska, 12 percent in Arizona, 7 percent in Idaho, 5 percent in Wyoming, 4 percent each were located in California and New Mexico, 3 percent in Utah, and 2 percent each were located in Colorado, Montana and South Carolina. Exploration also took place in Alabama, Arkansas, Michigan, Minnesota, Nebraska, North Carolina, North Dakota, Oregon, South Carolina, South Dakota, Texas, Virginia, Washington and Wisconsin. Most of these sites had prior exploration activity, suggesting that economic conditions were such that exploration companies were reevaluating prospects in light of perceived improvement in economic conditions in 2012, technological advancements that would improve recovery, or their proximity or geologic similarity to other recent discoveries.

The USGS conducted a review of the U.S. properties included on the tables of significant sites (included in Table 2) published in its annual

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In the United States, the U.S. Securities and Exchange Commission adopted rules mandated by the Dodd-Frank Wall Street Reform and Consumer Protection Act requiring resource extraction companies to disclose certain payments made to the U.S. government or foreign governments.

summaries of nonfuel mineral exploration from 1995 through 2010. The study noted that higher metals prices and new discoveries since 1995 have stimulated re-exploration of Nevada's established mineral belts and new areas, while much of the exploration activity in Alaska is focused on greenfield prospects in areas with a less mature history of production. Based on this review, the number of years from initial ore deposit exploration to initial production ranged up to 70 years. The average exploration and development timeframes were eight years for sites located in active mineral belts and 36 years for greenfield sites in the United States. The average timeframe required for permitting of these U.S. sites was determined to be four years for sites located in active mining areas and 10 years for greenfield sites from the time the operating permit application was received, although there was often an extensive period of time prior to formal permit application submission for permit planning and community input activities, which were not included in these estimates. There is a considerable range in permitting timeframes from site to site, based on numerous factors such as economic, environmental and geologic factors, land ownership issues and governmental legislation. Study data suggest that the United States has been able to maintain its gold and silver mine production rates since 2005 while maintaining gold and silver reserve levels primarily because of high metals prices and delineation of additional reserves by means of continued exploration.

A relatively high gold price has sustained interest in Nevada exploration. Based upon a 2011 survey conducted by the Nevada Division of Minerals, mineral exploration expenditures in Nevada were reported to be \$675 million in 2011 and expected to be similar in 2012. Exploration for metals accounted for 90 percent of 2011 expenditures. About 54 percent of the reported 2011 spending was for actual exploration activities, with the remainder used for land holding (22 percent), corporate overhead (14 percent), permitting and compliance (9 percent) and other expenses (1 percent). About 68 percent of Nevada exploration activity in 2011 was related to expansion of existing operations and 32 percent was related to development of grassroots projects. Based on preliminary data compiled for 2012, metals exploration was expected to represent 96 percent of projected expenditures for 2012. Based on U.S. Bureau of Land Management statistics, 196,000 active claims were reported for Nevada in 2011, and 225,000 claims were filed in 2012. Based upon survey results, more than 84 percent of the

respondents to the 2011 Nevada survey came from exploration entities with annual exploration budgets greater than \$5 million. The principal exploration objective in Nevada continued to be gold and silver, although exploration for copper, iron ore, lead, lithium, magnesium, molybdenum, potash, rare earths, tungsten, vanadium and zinc occurred in Nevada during 2012, based on USGS site data.

There was also significant exploration activity in Alaska during 2012, but compiled data were not yet available, although preliminary data suggest that exploration spending in Alaska would be less than the record amount spent in 2011. Based on a 2012 report released by the Alaska Department of Natural Resources, exploration expenditures (excluding development projects) in Alaska increased from about \$264 million in 2010 to about \$365 million in 2011. About 39 percent of the total estimated expenditure was to be spent in southwestern Alaska, 30.5 percent in the eastern interior, 7 percent in the south-central region, 9 percent in the southeastern region, 7 percent in the western region, 5.5 percent in northern Alaska and 2 percent on the Alaskan Peninsula. About 51 percent of this expenditure was for precious metals, 44 percent for polymetallic deposits, 2.1 percent for base metals and 1.9 percent for diamond, heavy mineral sands, tantalum, tin, rare earths and uranium and other industrial minerals, and 0.9 percent for coal and peat. In terms of deposit type, about 40 percent was spent exploring for gold intrusions, 33 percent for porphyries, 13.7 percent for massive sulfides, 8.6 percent for gold veins, 1.2 percent for PGE-Ni-Cu deposits and 3.5 percent for other deposit types. In 2011, about 322,600 m (1 million ft) of hardrock and 1,000 m (3,280 ft) of placer drilling took place in Alaska.

In the United States, the U.S. Securities and Exchange Commission adopted rules mandated by the Dodd-Frank Wall Street Reform and Consumer Protection Act requiring resource extraction companies to disclose certain payments made to the U.S. government or foreign governments. The U.S. Secretary of the Interior issued an executive order creating buffer zones within part of the Permian Basin in New Mexico that would not allow oil and gas drilling in selected zones, protecting potash deposits lying above the oil and gas deposits. The U.S. Department of Energy allocated \$120 million over five years for researchers from the Idaho National Laboratory and the Critical Minerals Institute in Ames, IA, to develop sustainable process to extract rare-earth minerals.

At the state level, the Alaska Division of Geologic and Geophysical Surveys is conducting a \$3-million program to catalog strategic mineral

deposits, including cobalt, platinum, rare earths and yttrium. In California, AB2205 was signed into law clarifying the use of lithium extraction technology in geothermal systems.

Pacific Region. Based on MEG data, the 2012 exploration budget allocation for the Pacific Region and Southeast Asia (excluding Australia) was \$1.35 billion, up 35 percent from the 2011 level of \$997 million. Indonesia, Papua New Guinea and the Philippines, together, accounted for about 83 percent of the total mineral exploration budget for the region when Australia is excluded. The increase in this region can be attributed to continued interest by Chinese and South Korean companies to expand sources of supply for strategic minerals such as gold, base metals and rare-earth elements, and by Japanese companies to develop regional copper and nickel deposits to supply Japan's smelting industry. Based on the data on active exploration sites compiled by the USGS, the three countries included in this region with the largest number of exploration sites were Indonesia, Papua New Guinea and the Philippines, together accounting for 66 percent of the active exploration sites in the region. Other countries with active exploration in 2012 include Cambodia, Fiji, Java, Republic of Korea, Laos, Malaysia, Myanmar (Burma), New Caledonia, New Zealand, the Solomon Islands and Vietnam. Gold and silver exploration accounted for approximately 60 percent of all exploration interest in the Pacific region, base metals accounted for about 40 percent, with miner exploration activity for iron ore, PGM, and other minerals in 2012. About 63 percent of the sites in this region were conducting early-stage exploration, 20 percent were exploring for minerals adjacent to producing mines, 11 percent were undergoing feasibility studies and 6 percent were in development.

Figure 9 shows exploration activity in the Pacific Region (excluding Australia) in terms of the percent of world share of exploration budget and number of active sites. Since 2008, the region's share of the world exploration budget has generally increased, while its share in terms of the number of active exploration sites has decreased. This trend reflects increasing investment in Southeast Asia and the Pacific Region by China. As China seeks sources of key mineral commodities to support its industrial growth, Chinese investors have increased funding for the development of promising deposits in Southeast Asia by means of joint venture agreements to develop selected advanced-stage deposits. Because of this, a greater share of the world exploration budget in this region is being

spent on a small number of exploration projects. A study by PwC reported that the Asia-Pacific region accounted for 68 percent of the value of mergers and acquisitions that took place in 2012.

Cambodia issued 128 mining concession licenses for exploration projects to local and foreign companies in 2011. The Indonesian government passed legislation requiring permits to export unprocessed raw materials, such as bauxite, and imposed a 20- to 50-percent tax on 14 minerals, if unprocessed. It also wants miners with existing long-term contracts to renegotiate deals increasing export royalties from the existing 1 to 10 percent. The Philippine government has proposed to raise the mining royalty rate above the current 5 percent rate. The South Cotabato provincial government has imposed a ban on openpit mining, threatening the development of Xstrata's Tampakan project.

Rest of the World. Exploration budget allocations for the rest of the world (including mainland Asia, the countries of the Commonwealth of Independent States, Europe and the Middle East) increased by about 28 percent in the MEG 2011 survey to about \$3.1 billion from the \$2.4 billion budget reported in its 2011 survey; the percent share remained at 15 percent in 2012. Russia and China accounted for about 46 percent of the region's exploration budget. Russia and China maintained their 3 and 4 percent share, respectively, of the total exploration budget in 2011 (excluding exploration activity conducted by government-controlled entities).

In terms of the number of exploration sites, the greatest amount of exploration occurred in Russia, China, Turkey, Sweden, Mongolia, Finland, Greenland, Kazakhstan, Serbia and India. On the basis of exploration site data collected by the USGS for this summary, Russia accounted for about 16 percent, China accounted for about 9 percent, Turkey accounted for about 8 percent, Sweden accounted for 6.5 percent, Finland and Greenland, Kazakhstan and Mongolia each accounted for about 5 percent, Serbia accounted for about 4 percent and India accounted for about 3 percent. The remaining 33.5 percent occurred in 30 other countries in Asia, the Commonwealth of Independent States, Europe and the Middle East. Exploration activity in Asia in 2012 primarily focused on gold (30 percent of all sites in this group had gold as the primary commodity), copper (13 percent), iron ore (10 percent), rare earths and graphite (each 7 percent), and base metals (6 percent) and other mineral commodities 27 percent. Exploration activity in the Commonwealth of

In terms of the number of exploration sites, the greatest amount of exploration occurred in Russia, China, Turkey, Sweden, Mongolia, Finland, Greenland, Kazakhstan, Serbia and India.

The China Development Bank investment division is looking at overseas opportunities for copper, iron ore, nickel and uranium. In 2012, Chinese investors focused on investments in Africa, Asia and Latin America and reducing investments in Canada and the United States, which are becoming more expensive.

Independent States focused on gold (73 percent), copper (14 percent), iron ore (8 percent) and rare-earth elements (4 percent). European mineral exploration primarily focused on gold (40 percent), base metals (26 percent), iron ore (7 percent), rare earths (5 percent), uranium (4 percent), lithium (3 percent) and the remaining 15 percent exploring for 13 other mineral commodities. Middle Eastern exploration (including Turkey) primarily focused on gold (58 percent), base metals (24 percent) and 18 percent for five other mineral commodities.

In an effort to supply its growing industry with raw materials, China opened its mining sector to foreign investment during the 1990s, extended its search for minerals by investing in foreign exploration and development projects during the last decade, and received approval to conduct deep-sea mineral exploration activities in the Indian Ocean in 2011. However, as the list of commodities prohibited from foreign investment increases, foreign investment in China is reduced. Based on a study of domestic reserves of 45 minerals, China's consumption of mineral resources is growing faster than its production, and its production is growing faster than its exploration. The China Development Bank's investment division is looking at overseas opportunities for copper, iron ore, nickel and uranium. In 2012, Chinese investors focused on investments in Africa, Asia and Latin America and reducing investments in Canada and the United States, which are becoming more expensive. Chinese activity in Canada, Australia and the United States is focused on acquiring companies that have access to viable mineral resources. *The Los Angeles Times* reported China's acquisitions of U.S. companies has increased from about \$1 billion in 2008 to \$7.7 billion as of August 2012.

In 2012, other notable Chinese activity related to mineral resource include the country's focus on acquiring access to Indian iron ore, an agreement to develop the Las Cristinas gold mine in Venezuela and its controversial stockpiling of domestic rare earth reserves while it continues to regulate its domestic industry and limit rare earth exports.

Since the ban on iron ore mining in India's Karnataka state in 2011 for environmental concerns, illegal iron ore mining has taken place in the state, causing the government significant lost revenue. The government lifted the ban and allowed 18 mines to resume iron ore production in 2012. However, it continued to ban companies from exporting iron ore fines that must be used for domestic iron or steel making. In an effort to update mineral maps of India, a \$1.4-billion, five-year project has begun with the British

Geological Survey conducting an airborne geophysical survey of the region.

Development of the Reko Diq copper-gold deposit was suspended in 2011 after its application for a mining license was rejected. Pakistan's Supreme Court ruled in 2012 that the joint venture agreement to develop the project was invalid.

In Greenland, legislation setting the framework for foreign exploration and mining in the country was passed in 2012. The legislation defines what is to be classified as a large-scale project and regulates minimum salary levels for foreign workers. According to Statistics Greenland, the number of exploration licenses granted in Greenland has increased from 33 in 2005 to 75 in 2011.

A new tax law was ratified in Poland that would tax copper and silver based on the mass of extracted commodity and would be evaluated monthly. The maximum tax rate for the extraction of copper is PLN 16,000/t (\$5,000/t) and the maximum tax rate for extraction of silver is PLN 2,100/kg (\$660/kg).

Since the mineral potential of Afghanistan was first reported in 2010, a number of reports by the USGS and others have detailed this country's mineral potential. To date, conflict and the lack of mining regulations has hampered mineral development by western companies, although a draft mining law is currently under review in 2012. Two resource development projects in Afghanistan are ongoing. The Aynak copper project is to be developed by China Metallurgical Group and Jiangxi Group and negotiations are in progress between an Indian steel consortium and a Canadian junior exploration company to develop the Hajigak iron ore deposit.

For more information

The USGS collects and analyzes data on more than 100 mineral commodities in the United States and worldwide. This article draws from public and private sector sources and the knowledge and expertise of USGS mineral commodity, country and mineral-resource specialists. More detailed information on the material covered in this article may be obtained from the author, David Wilburn, U.S. Geological Survey, PO Box 25046, MS 750, Denver Federal Center, Denver, CO 80225-0046; telephone 303-236-5213; fax 303-236-4208 or wilburn@usgs.gov. For additional USGS information on mineral commodities and international mining activities, inquiries may be directed to Michael Magyar, U.S. Geological Survey, 988 National Center, Reston, VA 20192; telephone 703-648-4910 or mmagyar@usgs.gov. ■